

# A study of small satellites capture in corotation resonance

**Vieira Neto, E., Araújo, N.C.S.,**  
Universidade Estadual Paulista – UNESP  
**Sicardy, B.**  
Observatoire de Paris

46th ESLAB SYMPOSIUM  
Formation and Evolution Moons

26/06/2012

# Corotational Resonance

- Pattern Speed:

$$m\Omega_p = mn' + k\kappa' + p\nu'$$

- In Corotational Resonance the frequency of the perturber is the same as the pattern speed:

$$m(n - \Omega_p) = 0$$

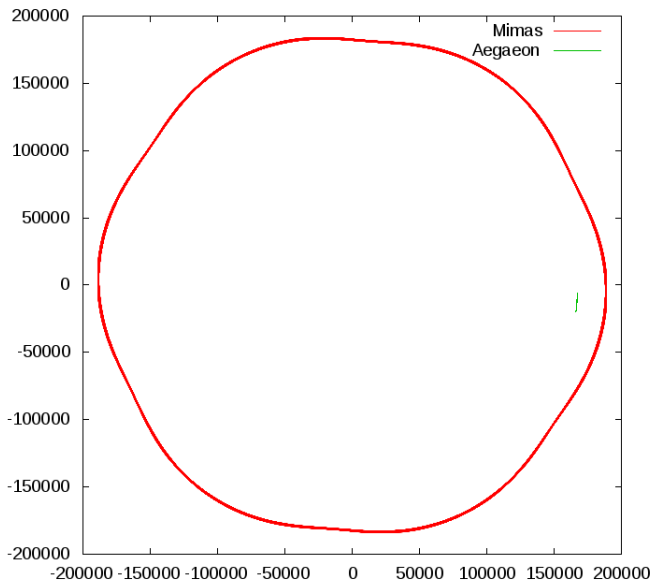
- Resonant Angle:

$$\varphi_{CR} = m(\lambda' - \lambda) + (m - p)(\lambda - \varpi)$$

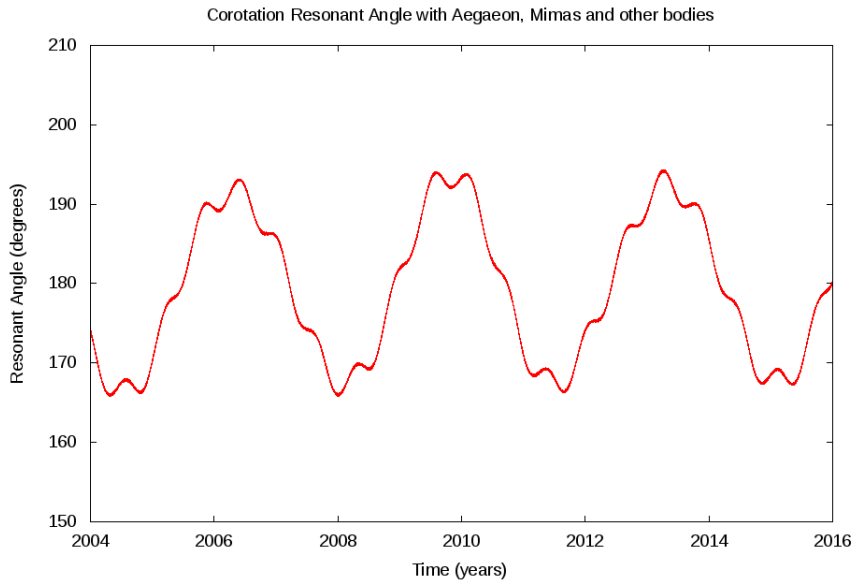
# Saturnian System

- In the Saturnian System there is three satellites in corotation resonance with Mimas
  - Aegaeon 6:7,  $6(\lambda' - \lambda) - (\lambda - \varpi)$
  - Anthe 11:10,  $11(\lambda' - \lambda) + (\lambda - \varpi)$
  - Methone 15:14,  $15(\lambda' - \lambda) + (\lambda - \varpi)$

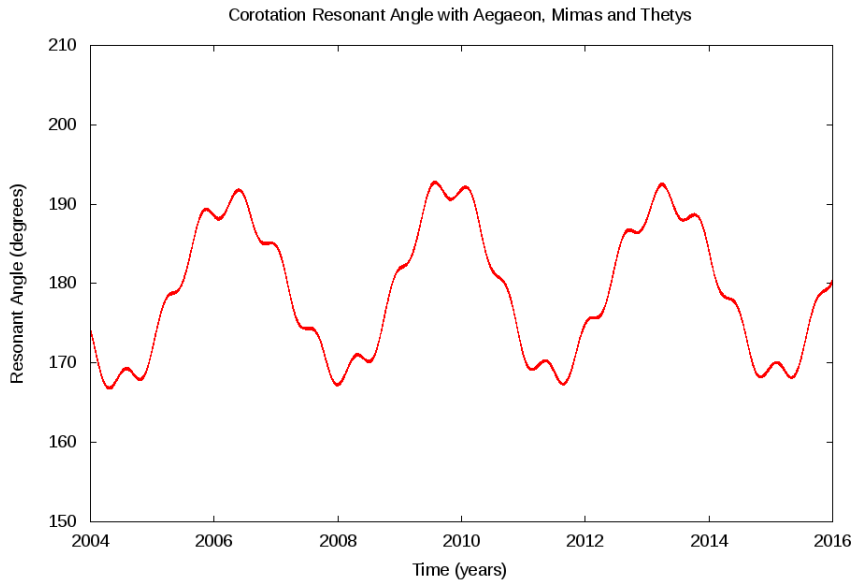
# Aegaeon's resonance



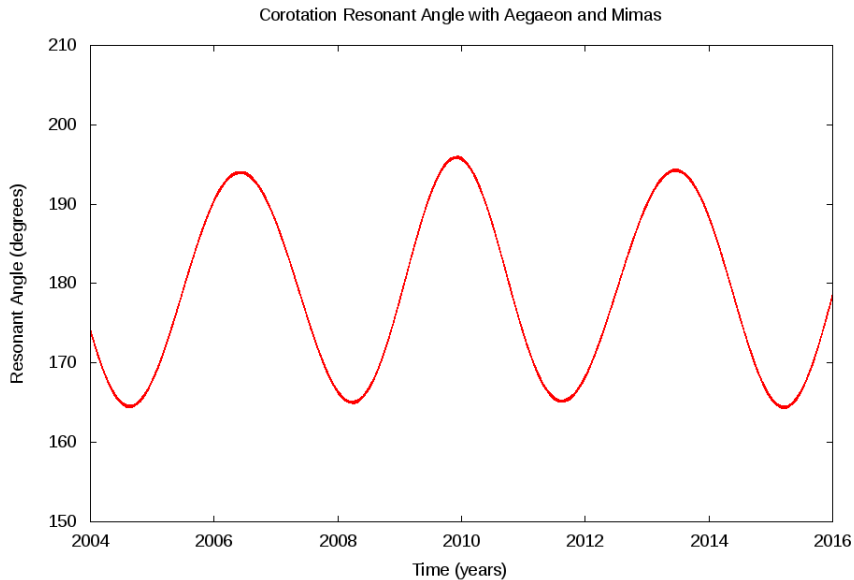
# Aegaeon's resonance



# Aegaeon's resonance



# Aegaeon's resonance



# Questions

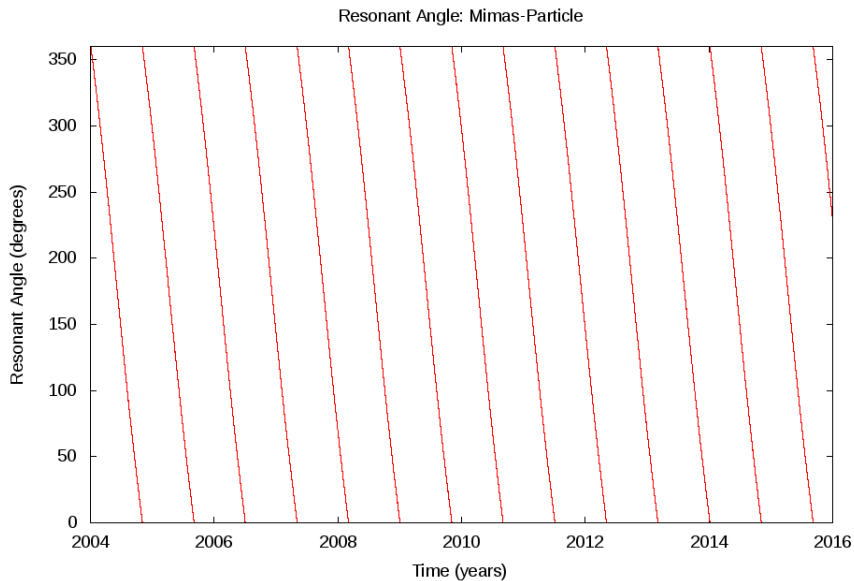
- How Aegaeon enters this resonance?
- Was it a captured satellite?
- Does it born in this corotation resonance?
- Dynamical study of corotation resonance



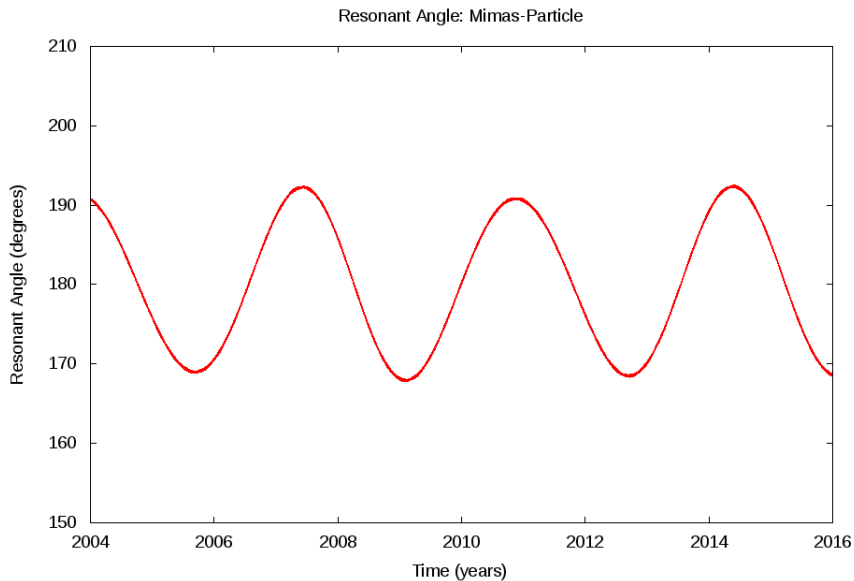
# Numerical definition of corotation

- Resonant angle is measured at each time step
  - if it circulates
    - we say the particle is not in corotation with Mimas
  - otherwise
    - we say the particle is in corotation resonance

# Not in Corotation Resonance



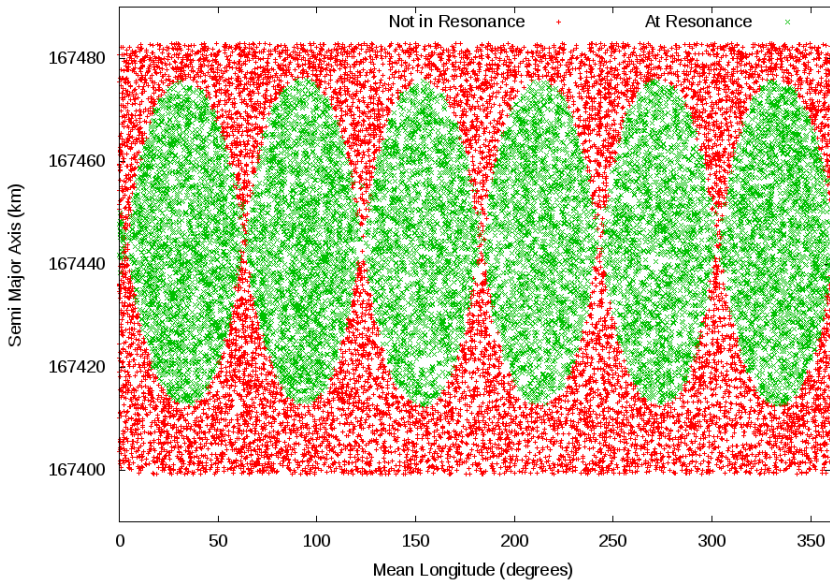
# Corotation Resonance



# Classification

- With this definition we made Monte-Carlo simulations, varying semi-major axis, and mean longitude of the orbital elements of Aegaeon and classify the outcomes.

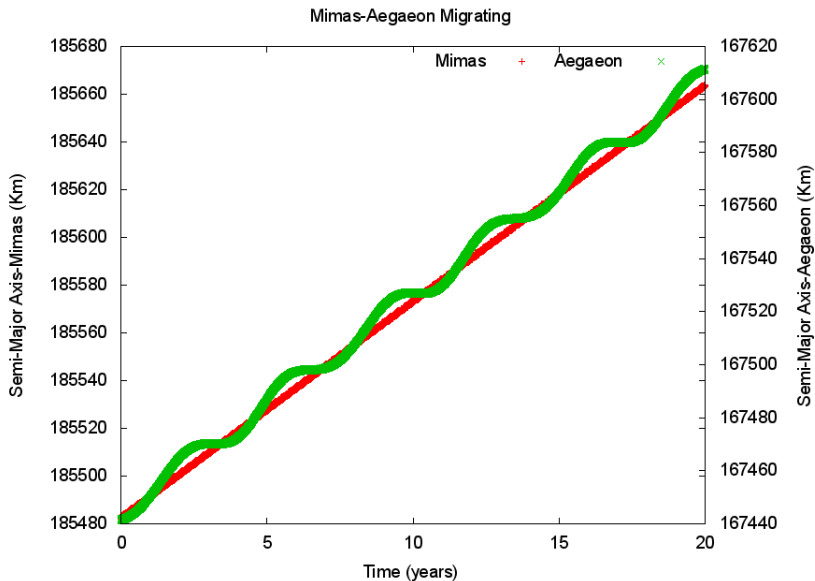
# Classification



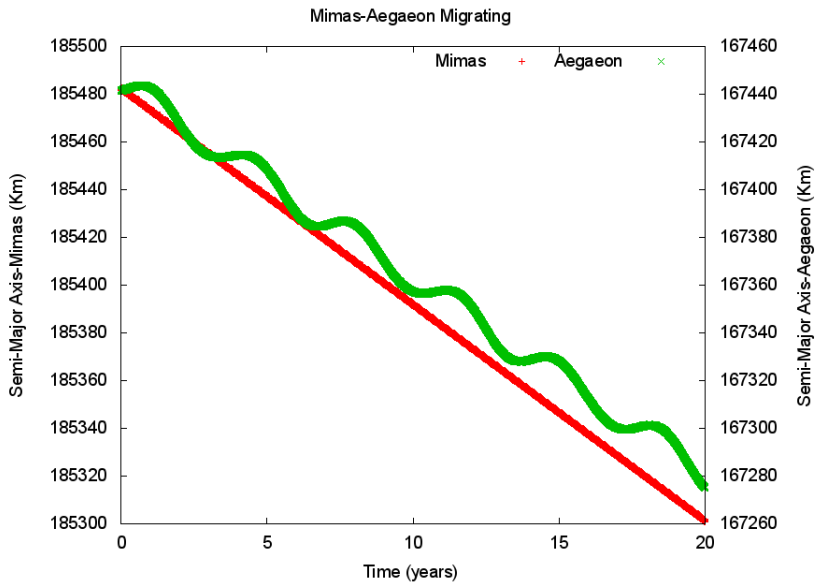
# Mimas Migration

- With the corotation sample we studied the effect of Mimas migration.
  - We put a drag force only in Mimas dynamics
  - First we test with Aegaeon

# Negative Drag

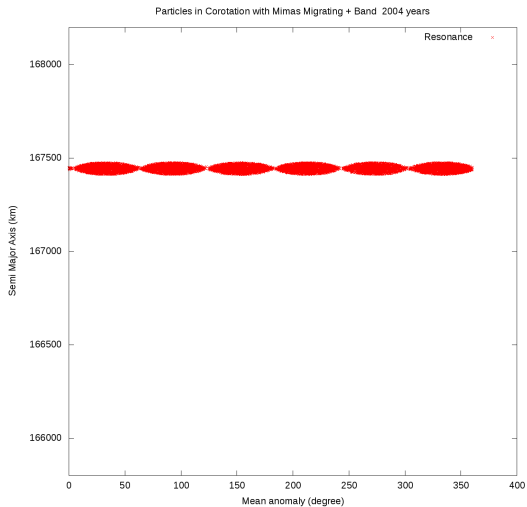


# Positive Drag

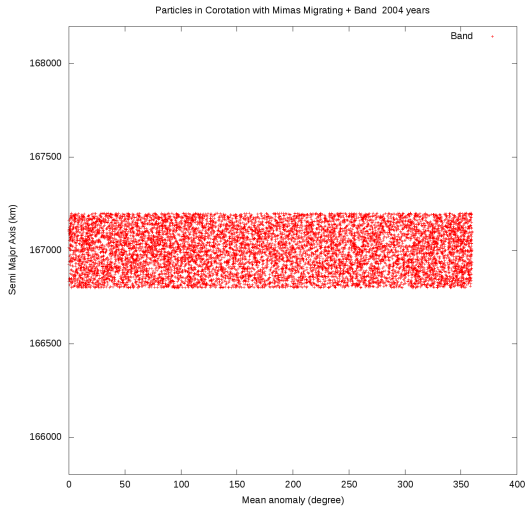




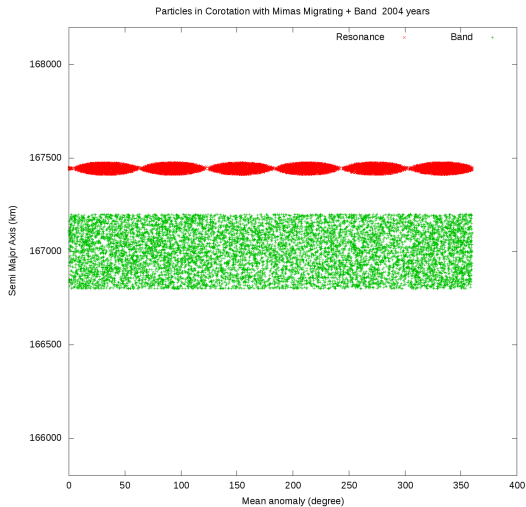
# Migrating Mimas



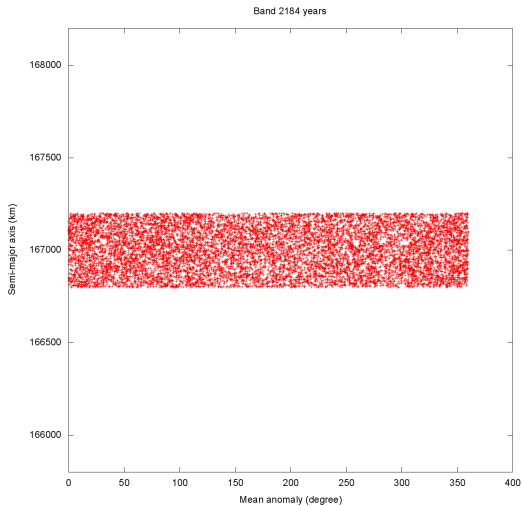
# Migrating Mimas



# Migrating Mimas



# Migrating Mimas



# Conclusions

- Corotation resonance is very robust.
- Although some particles moves in the border of the corotation resonance, none of them really enters the corotation.
- Others possibilities:
  - Slower migration
  - Mimas growth